6. Summary and Discussion

Textural and compositional data generated for the EMR permits a quantitative comparison of the sedimentology for Australia's East Margin. The data build on the predominantly qualitative studies that currently exist for the region. The following provides a comprehensive description of the sedimentology and geomorphology of the EMR, including information from previous studies (Section 3) and new results (Sections 4 & 5). The implications of seabed sediment distribution for marine habitat mapping are also discussed.

6.1. SUMMARY OF THE SEDIMENTOLOGY AND GEOMORPHOLOGY OF THE EMR AS DESCRIBED FROM EXISTING LITERATURE

The shelf in the EMR is subject to relatively high wave and current energy and has had a low sediment supply since sea level reached its present position some 6,000 years ago. This has had a profound effect on the geomorphology of the sea floor and on the texture and composition of sediments found on the shelf. The shelf is shaped by the topography that was drowned as sea level rose. A wedge of sediment of varying width and thickness has accumulated during the late Cainozoic and characterises the shape of the outer shelf and upper slope (Davies, 1979; Roy and Thom, 1991).

The inner shelf is shaped by the submarine extension of coastal headlands and rock outcrop and rock debris are common on the sea floor. Quartz sand ridges abut this outcrop in many places and some are modified relict shorelines. Ripples and dunes in the sand and scours around rock outcrops are common on the shelf and are evidence for mobile sediment on the sea floor. This is particularly so north of Fraser Island where the quartz sands that are moving north by longshore drift form the Breaksea Spit that extends across the shelf to the shelf edge (Boyd et al., 2008).

The mid-shelf is characterised by the deposition of fine sediments that have been able to accumulate below fair weather base, inboard from the effects of the EAC. The only significant accumulations of mud in the sand occur where the shelf is wider south of Sugarloaf Point at three locations: offshore of Newcastle, north of Sydney and Wollongong (Matthai and Birch, 2000a). North of Sugarloaf Point there is evidence that the EAC has affected sediments at all depths except in the larger embayments (Jones and Kudrass, 1982; Rule et al., 2007).

The outer shelf is generally a flat plain that is dominated by carbonate sediments, much of it relict (Marshall and Davies, 1978). Winnowing by the EAC has led to the accumulation of shelly and ferruginous gravels on the outer shelf in many places. Off Queensland significant carbonate banks have formed on the outer shelf with rhodolith gravels and carbonate hardgrounds on the sea floor.

The slope in the EMR is characterised by being relatively steep and having a relatively low rate of sediment accumulation. On the slope there are the competing processes of erosion and deposition to modify the topography inherited from plate tectonics. Canyons and scars from gravity slumping are a major feature of the NSW-Queensland slope in the EMR. They occur 50 to 100 km apart, generally off major drainage systems on land. The canyons are smaller on the Queensland section of the slope. The erosion of canyons has exposed a variety of rock types (Heggie et al., 1992; Packham et al., 2006). The canyons are also important as conduits for nutrient-rich water to reach the shelf. Nowhere are canyon heads incised into the shelf break but in 13 cases they have incised to the 150-300 m isobath. In general, the upper slope down to 1,500 m is a smooth surface of unconsolidated sediments. These sediments are the seaward face of the sediment wedge that underlies the shelf edge. Slide scars and evidence of creep are present in the toe of this sediment wedge below 1,000 m. Most of the large canyons form from tributaries coalescing on the mid-slope where large slope failures have occurred.

From north of Brisbane to Breaksea Spit on the northern tip of Fraser Island small canyons and gullies have incised the upper slope to water depths of 150 m. Above this depth the upper slope is very steep due to outcrop of limestone platforms (Marshall et al., 1998). This is the only area where significant amounts of sediment are reaching the heads of canyons. Quartz and carbonate sand from the inner shelf is found in canyons down this slope (Boyd et al., 2008). Elsewhere the canyons are considered inactive and would have a floor draped in hemipelagic mud.

A prominent geomorphic feature of the lower slope is the major scarps, up to 2,000 m high and extending for 10s of kilometers along the base of slope where it has an abrupt contact with the abyssal plain/deep ocean floor. These scarps represent fault surfaces that were formed during breakup of the continental crust along this margin 70 to 60 million years ago. Rock and rubble are exposed on these scarps. The base of the continental slope is at 5,000 m in the south and 4,600 m in the north off Fraser Island.

At all water depths throughout the EMR the sea floor sediments are well oxygenated. This reflects the relatively low productivity in the surface waters, and hence the oxygen minimum zone in the water column between 1,000 and 2,000 m is poorly developed and benthic communities are not affected where it impinges on the slope. Both rock and sediment form the substrate on the slope. Most rock outcrops are in water depths >1,500 m on the sides of canyons, igneous pinnacles and domes and on fault scarps. The only rocks on the upper slope are cemented hardgrounds off northern NSW, volcanic ridges off Wollongong and Port Macquarie, a seamount off Sydney and a limestone platform off Fraser Island. In general, the sediment is muddy sands and sandy muds, composed of about half carbonate and half terrigenous particles (Troedson and Davies, 2001). Scours around rock outcrops indicate that the EAC can winnow the sediment down to 1,000 m water depth. The sediment becomes more mud rich below this depth. The carbonate fraction is dominated by the calcite remains of foraminifers (sand size) and coccoliths (mud size). Minor amounts of pteropods, echinoids and sponge spicules (both silica and calcite) are also present. The terrigenous fraction is fine quartz and clay minerals. The two exceptions to this distribution of sediment texture and composition are sands on the upper slope off Queensland, where bottom sediment has been transported over the shelf edge, and off northern NSW where phosphate, glauconite and ferruginous gravels and slabs occur on the sea floor.

The abyssal sea floor of the Tasman Sea receives very little sediment today because: plankton productivity is low in the surface waters; its depth of 4,800-5,100 m leads to dissolution of carbonate particles, and little sediment is supplied from land because all except one canyon system are inactive. In the north of the basin the sea floor is shallower because there has been more sedimentation in the past, from turbidity currents generated by a greater supply of sediments to the slope. The abyssal plain extends approximately 200-250 km out from the base of slope. It was formed by deposits from turbidity currents filling the underlying volcanic topography on the oceanic crust. East of the abyssal plain are abyssal hills where the volcanic topography is draped by pelagic sediments. There are no fans or large debris aprons at the base of slope. This is unusual and probably due to bottom currents redistributing the sediments. Scours in the sediments, sediment drift deposits and moats are all evidence of strong bottom current activity along both the east and west margins of the basin and around seamounts (Jenkins, 1984). Sediments on the abyssal sea floor are slowly accumulating brown clays or calcareous muds overlying turbidite deposits. Manganese nodules occur in the abyssal hills region.

Seamounts are a major feature of the EMR. They vary in size from 2 to 50 km wide at their base and range in height from 10s of meters to ~5,000 m. They occur all over the Tasman abyssal sea floor, on the plateaus and ridges and in the Norfolk Island region. Some were formed during sea floor spreading, others were formed by the plate moving over hot-spots in the mantle. The youngest discovered to date are on Lord Howe Rise and Norfolk Island (~2 Ma). Two major seamount chains run north-south with the younger seamounts (~7 Ma) in the south and seamounts of Oligocene age (~30 Ma) in the north (McDougall and Duncan, 1988). Many reach the surface to form island and carbonate reefs, others have subsided below sea level and are capped with limestone, and have a flat summit within 500 m of the sea surface. The seamounts are composed of basalt which is coated with manganese crust where it has been exposed on the sea floor for a long time. They shed carbonate and volcanic debris to the sea floor below by gravity slumping.

The Dampier Ridge and Lord Howe Rise are plateaus mostly 1,000 to 2,000 m below sea level that are blanketed in pelagic ooze consisting of foraminifers and coccoliths. They have steep sides, along some margins the scarps have over 1,000 m of relief. Slumping, gullying and small canyons occur on all slopes. Volcanic activity has formed some of the scarps on both plateaus. There is also evidence of relatively recent volcanic activity forming small seamounts on the LHR itself. Moats around seamounts on LHR suggest the presence of relatively strong bottom currents.

The Marion and Queensland Plateaus dominate the northern part of the EMR. They have a similar origin due to subsidence of continental crust attached to Australia to form marginal plateaus, followed by a period of carbonate platform construction in the Miocene (Davies and McKenzie, 1993). Reef growth on these platforms has led to carbonate platforms/atolls at the sea surface being major geomorphic features today. These atolls have very steep upper slopes where limestone is exposed. Scalloped morphology on their margins indicates mass slumping of material into the adjacent deeper water (Francis et al., in press). The platforms/atolls shed shallow water carbonate sediments to the surrounding sea floor. Many smaller platforms and pinnacles are drowned features. Limestone outcrops on the sea floor occur on both plateaus. Elsewhere, pelagic carbonate is the dominant sediment with the terrigenous mud content greater in the troughs between the plateaus and the shelf. There is strong evidence of bottom currents eroding the sediment and modifying the sea floor on the plateaus (Exon et al., 2005). Both plateaus have steep sides with small canyons and gullies leading into the adjacent basins and troughs.

East of the marginal plateaus is an area with complex geomorphology that is poorly surveyed. There is evidence for extensive volcanism in the Cato Basin area and around Mellish Reef (Exon et al., 2006a). Narrow ridges and basins characterise the area. Turbidites have formed a smooth floor in the basins whereas the ridges are rugged. Erosion and sediment movement on the ridges is confirmed by sand waves and scours. Slumping and small canyons occur on the slopes and channels have been eroded in the sediment in the troughs. Pelagic carbonate sediments drape the highs and have been redeposited into the lows. In the northeast of the EMR the presence of diatoms in the sediment from the Coral Sea Basin suggests higher surface water productivity due to the Southern Equatorial Current. In the narrow northwest section of the EMR there is a greater supply of terrigenous sediment than in other areas, as it is sourced from the rivers flowing into the Gulf of Papua.

The area around Norfolk Island in the EMR is divided in two by the N-S Norfolk Ridge. To the west the Fairway Basin floor is quite rugged compared to the smooth flat floor of the New Caledonia Basin. They are separated by a steep-sided rugged ridge with scarps of up to 1,000 m. Norfolk Ridge itself has a relatively flat top <2,000 m deep with three large areas in less than 500 m of water. Wanganella Bank at the boundary of the EMR in the south is less than 100 m water depth. East of Norfolk Ridge is a complex topography of basins, ridges and plateaus with numerous seamounts and submarine escarpments. At least four large seamounts come to within 1,000 m of the sea surface (DiCaprio et al., in press). Rock outcrop is abundant in this region. Sediments in the area are pelagic carbonates with a minor contribution from radiolarians, diatoms and volcanic ash. There is some evidence of bottom currents affecting the sediments on the tops of seamounts and ridges.

6.2. SUMMARY OF SEDIMENTOLOGY AS DERIVED FROM SEDIMENT DATA FOR THE EMR

New consistent quantitative data for the EMR have revealed regional scale patterns in sediment distribution not apparent in previous studies, and forms a framework within which local scale patterns can be understood in a regional context. New data reveals some of the seabed complexity. At a regional scale our data show that the seabed sediments generally become finer with increasing water depth. Variation in sediment texture and composition generally decreases with increasing water depth, with sediments on the rise and abyssal plain/deep ocean floor being relatively homogeneous compared to those on the shelf and adjacent slope.

The shelf is predominantly composed of sand and the abyssal plain/deep ocean floor composed of mud. This trend is reported in reports by Geoscience Australia for other areas of the Australian margin (Potter et al, in press). Areas of gravel are localised and occur mainly on the inner, mid and outer shelf/slope, and are generally absent from the abyssal plain/deep ocean floor. Calcium carbonate concentrations are highest on the shelf and upper slope, and lowest on the lower slope rise and abyssal plain/deep ocean floor. Calcium carbonate content increases adjacent to the Great Barrier Reef Marine Park where calcium production is high.

At a regional scale our results agree with previous sedimentological work on the shelf, slope and abyssal plain/deep ocean floor. Our data indicate distinct variations in the sediment characteristics for the shelf, slope and abyssal plain/deep ocean floor. Our data also provides an analysis of the sediment texture of the rise within the EMR.

Our data indicate distinct variations in sediment characteristics along the inner and outer shelf, and mid to upper slope, due to high current and wave energy. These sediment characteristics were reported at local scales by (Gordon and Hoffman, 1986; Short and Trenaman, 1992; Roy et al., 1994a; Middleton et al., 1997). New data have allowed us to more accurately map the extent, and recognise the regional significance of these sedimentary characteristics.

High resolution data for the seabed in the EEZ indicate that geomorphic features are characterised by a combination of several environments with zones of transition between the features. For some geomorphic features, the new data allow us to more accurately predict and distinguish between the range of environments present and, where data are adequate, estimate the relative proportions of these. Distinct sedimentary environments occurred in some geomorphic features and these include: abyssal plain/deep ocean floor, basin, shallow and deep water terrace, slope, plateau, and trench/trough.

6.2.1. Shelf

Seabed sediments of the shelf are sand dominated, with a large carbonate component with >50% of samples containing between 50 and 100%. Bulk carbonate content increases with sand content and sand content decreases with water depth. Our data indicate that localised deposits of mud occur in the vicinity of Newcastle. This pattern corresponds to the high mud content found off the Hunter River as observed by Matthai and Birch (2000a). Our data also detected additional comparable areas of gravel (~40-80%) present locally offshore of Stradbroke Island, within Hervey Bay, north of Brisbane and offshore of Wollongong. Our results are consistent with Marshall and Davies (1978) description of the carbonate dominated outer shelf sediments. Associations between our sediment data and previous facies models for some areas of the inner shelf are difficult to resolve due to local areas of sparse data. Our data show that the regional trend for the shelf appears to be dominated by carbonate sand with localized accumulations of gravel and mud as seen by Marshall and Davies (1978).

6.2.2. Slope

At a regional scale, sediments of the inner slope mostly comprise sand, while seabed sediments of the outer slope are dominated by mud. Further, mud content increases with water depth on the abyssal plain/deep ocean floor and rise. Sediment data for this province are relatively scarce, however the available data provide significantly higher coverage for this area than was previously available. Carbonate content increases with sand content with localised concentrations of bulk carbonate ranging between 40 and 100% offshore outside Hervey Bay, Stradbroke Island and to the south of Wollongong. Gravel content is generally low, however localised aggregations occur in large quantities offshore Hervey Bay, Mackay and to the south of Cairns. Smaller localised concentrations of gravel occur offshore Coffs Harbour, Byron Bay and to the north of Brisbane. Mud content on the upper slope is low, however localised clusters occur offshore Wollongong, Newcastle, Port Macquarie and north of Coffs Harbour.

Our results reveal that at a regional scale the greatest variety of sediments occur in areas containing several geomorphic features and between bioregions (i.e., features adjacent to seamounts with higher gravel amounts although there were low sample numbers taken from seamounts). This is particularly evident where features with a distinct sedimentology are interspersed with other features with a distinct sedimentology (i.e., gravel dominated pinnacles located within the homogenous, sand dominated shelf).

Addition of data in geomorphic features occurring on the shelf and inner slope have resulted in the first quantitative analysis of the sedimentology of features occurring at these water depths in the EMR, including trenches, plateaus and terraces. Sediment data show that some features in this zone are characterised by a distinct sedimentology that differentiates each feature from one another. These features include: plateaus, terraces, trench/troughs, shelf and slope.

Our data provide further evidence for extensive carbonate deposits on the outer shelf with localized deposits of rhodolith gravels on the sea floor (Marshall and Davies, 1978). The outer slope contains a higher proportion of mud (20-90%) than found on the adjacent shelf.

6.2.3. Abyssal Plain/Deep Ocean Floor

Sediment samples procured for this task from the abyssal plain/deep ocean floor have significantly increased the sample coverage and understanding of the sediment properties. The abyssal plain/deep ocean floor is a relatively homogenous sedimentary environment dominated by calcareous mud containing foraminifers and coccoliths with small inclusions of sand and gravel. Our data concurs with the findings of Jenkins (1984) who described the sedimentology of the abyssal plain/deep ocean floor as brown clays or calcareous muds. The bulk carbonate content of sediments in deep water areas of the EMR provides further evidence that content range between 5 and 55% (Eade & van der Linden, 1970).

6.3. IMPLICATIONS FOR MARINE HABITAT MAPPING

Conservation of benthic marine habitats requires information on the geomorphology, sedimentology and oceanography of an area. The use of sediment properties as physical surrogates for benthic biological data that can be measured with ease, (Bax, 2001), may provide a greater understanding of marine ecosystems (Post, 2006). Relationships are recognised to exist between the texture and composition of seabed sediments and biota (Day & Roff, 2000; Roff et al., 2003; Roff & Taylor, 2000). For this reason, sediment properties as measured in this study are an important input into statistical models used to approximate the nature and extent of seabed marine habitats (see the seascapes of Day and Roff, 2000 and Whiteway et al., 2007). The accuracy of the seascapes in representing seabed habitats is directly related to the quality and resolution of underlying sediment data. Major sources of spatial error in sediment data used to characterise habitats are the result of low data density and inadequate interpolation methodologies. Addition of new data helps reduce these sources of error and allows recognition of relationships between physical datasets that are useful in developing more effective interpolation techniques.

Benthic biota have been shown to have measurable relationships with the gravel and mud content of seabed sediments (Post, 2006; Bax and Williams, 2001). Our data show that where the sedimentology is relatively diverse, such as on the inner shelf and on the slope, the sediment properties including gravel and mud content varies greatly over relatively small distances. A higher sample density is required in these environments to more accurately map the spatial distribution properties (and by association benthic biota), however the complexity of the seabed is beginning to be resolved. Our data have improved sample coverage in these areas, however additional coverage will further increase the reliability with which this can be mapped. In areas where seabed environments are relatively uniform, such as over most of the abyssal plain/deep ocean floor, sediment properties are more constant over larger distances, and the physical characteristics can be accurately mapped from fewer samples.

Our synthesis of sedimentology and geomorphology has;-

a) provided a more improved understanding of the range of seabed sedimentary environments present in the EMR,

b) allowed comparison between sedimentary environments occurring in different areas culminating in the identification of rare or unique areas of seabed that may be of particular interest for conservation; and

c) described relationships between physical datasets providing full coverage of the EMR, such as bathymetry and geomorphology, and sediment distribution; and

d) provided the first most up-to-date synthesis of all data and studies for the EMR. These can be used to help predict the sedimentary environments that occur in areas where sediment data points are relatively scarce. New data on the abyssal plain/deep ocean floor, plateaus and terraces have allowed characterisation at a higher confidence.

6.4. LIMITATIONS

Although we have added significant detail to the regional sedimentology of the east margin, including better defined local and regional trends, the data are still relatively sparse in deep water areas, which limits the degree to which we can fully describe the sedimentology. It is important to recognise some of the limitations of the data.

Data in the EMR is clustered on the shelf, with a paucity of data for the outer slope and abyssal plain/deep ocean floor. This means that sediments present in areas with most data are likely to be over-represented in statistics at a regional scale. Uneven distribution of data also makes it difficult to statistically quantify relationships that are observed visually in data, and means that existing relationships may not be detected and utilised when interpolating data to rasters for input into seascapes. While this may cause some inaccuracy or bias at a regional scale, the structure of our analysis with observations and statistics generated for individual bioregions, provinces and features means that sedimentology at these scales is not significantly affected. Because data density is greatest on the shelf we place more confidence in the sediment patterns. However, complexity elsewhere may not have been detected due to relatively low sample density.

In this study we have used the inverse distance weighted method, with a fixed interpolation parameter, which has been used by Geoscience Australia to interpolate all of its point data across Australia's marine jurisdiction. This provides for a comparable and consistent dataset. The maximum distance that any data were extrapolated was 45 km. This method is adequate, where large ranges in data density occur, to produce maps that allow identification of trends in sediment distribution occurring at a regional scale, but may not necessarily represent sediment distribution at finer scales.

The key question in modelling studies is "*How much simplification is acceptable?*" A linear inverse distance weighted method (with a fixed interpolation parameter) does not necessarily represent all trends in sediment distribution. However, no interpolation method is able to pick up such trends if sample density is inadequate. Trends in sediment distribution in the EMR are known to occur on scales from centimeters to hundreds of kilometers. Without knowing at what scale variations in sediment characteristics are significant in mapping distribution of species, it is difficult to comment on how much uncertainty in interpolated data affects results generated for seabed habitat mapping.

Sample density for the EMR is 15:1,000 km^2 on the shelf, >1:1,000 km^2 on the slope, >1:1,000 km^2 on the rise and >1:1,000 km^2 on the abyssal plain/deep ocean floor. This provides the minimum distances over which variations in the sediment properties can be detected. Interpolation images must be used with caution when drawing comparison between seabed composition in different areas of the EMR as they do not necessarily represent: 1) the relative proportions of environments present in an area; or 2) the way sedimentary environments are interspersed spatially, as resolution of the interpolation is more a reflection of sample density than diverse sedimentology.

6.5. RECOMMENDATIONS

To improve interpolated data sets and confidence in representing the true characteristics of the seafloor, it is important to improve sample densities in areas of the seabed that contain significant variations in sediment characteristics over relatively small distances. As collecting sediment samples from the seabed is highly time consuming and costly, information about distribution of seabed complexity and the relationship to geomorphology can be used to target areas where data coverage is likely to be inadequate. New data generated for the NWMR and the SWMR (Potter, in press) allows recognition of relationships between relatively diverse seabed sedimentology and geomorphic features such as seamounts and surrounding plateaus and basins. In the EMR, sample densities in these features remain relatively low. New data for the EMR also indicates that although sediments are more homogenous in deep water areas (e.g., abyssal plain/deep ocean floor), greater variation may be captured in these areas than is captured in the current data. Data generated for this study have significantly improved sample densities for these areas and this work should be continued, particularly for the abyssal plain/deep ocean floor, slope and rise.

Data collection, advances in interpolation methods, and improved understanding of relationships between geomorphic features and sediment type, will improve the accuracy of future sedimentology work conducted at a Regional Marine Planning area scale. An improved understanding of geomorphic features such as the abyssal plain/deep ocean floor is required to more accurately map sediment distribution. Where sample coverage is sparse, the inclusion of secondary datasets in the interpolation process will allow the prediction of sediment type. Secondary datasets such as energy level, tidal regime, sediment transport pathways, and previous sediment models will improve the accuracy of future seabed sediment mapping. Our study has shown that future sampling in the EMR should focus on areas with poor sample coverage such as the abyssal plain/deep ocean floor, pinnacles, deep/hole/valleys, reefs, bank/shoals, knoll/abyssal hill/hill/peaks, ridge, outer shelf, lower slope and rise.

Geoscience Australia has a program to asses the accuracy and precision of interpolation techniques, and is investigating the usefulness of secondary datasets during interpolation.

6.6. SUMMARY

The EMR is characterised by a variable geomorphology and sedimentology. Sediment texture and composition displays a zoning with depth and bioregion, and sand and gravel dominate the shelf area whilst mud dominates the lower slope and abyssal plain/deep ocean floor. Calcium carbonate concentrations throughout the region are generally highest along the shelf to the shelf edge and are associated with reefs. Significant geomorphic features of the EMR with sedimentological information include; shelf (unassigned), slope (unassigned), AP/DOF (unassigned), basins, deep water trench/troughs, shallow and deep water terraces and plateaus.

Geoscience data plays a vital role in the management of Australia's ocean resources because we may never have a full inventory of all biota found on the seabed. Geomorphology and sedimentological data can be mapped relatively easily and this can be used as a surrogate between the distribution and abundance of benthic biota and seabed habitats. The relationship(s) between geomorphology and sediment/substrate type and biota is a key priority for future marine research.

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8. Appendices

8.1. APPENDIX A: PROJECT STAFF

Name	Substantive Role
Dr Andrew Heap	Project Manager/Geomorphologist/Sedimentologist
Dr Jock Keene	Project Scientist/Geomorphologist/Sedimentologist
Anna Potter	Project Scientist/Sedimentologist
Christina Baker	Project Scientist/Sedimentologist (DEWHA funded)
Maggie Tran	Project Scientist/Sedimentologist (DEWHA funded)
Stuart McEwen	Laboratory Manager
Christian Thun	Senior Laboratory Officer
Tony Watson	Senior Laboratory Officer
Alex Mclachlan	Senior Laboratory Officer
Keith Henderson	Laboratory Officer
Billie Poignand	Laboratory Officer
Kylia Wall	Laboratory Officer (DEWHA funded)

8.2. APPENDIX B: MAPPING PARAMETERS

8.2.1. Gravel, Sand, Mud and Carbonate Maps

- data imported to ArcGIS in csv format
- interpolate to raster using:
  - i) inverse distance weighted interpolator
  - ii) cell size of 0.01 decimal degrees (dd) – about 1 kilometre
  - iii) optimal parameters: search radius of 12 points and power parameter of 1 (Ruddick, 2006).
  - iv) maximum extrapolation distance of 0.45 dd – about 45 kilometres
- raster image clipped to Australian Economic Exclusive Zone limit and the National Mapping 1:250,000 coastline from the National GIS.
- additional clip areas were added where interpolator extrapolation produced
- artefacts that were not consistent with the surrounding data points.

8.2.2. Sedbed Sediment Type – Folk Classification

- rasters for fractions were created as in #.2.1 but with a cell size of 0.05dd.
- rasters were exported as 0.05 dd grids of points
- samples were allocated to one of 15 Folk sediment type classifications based on gravel/sand/mud percentages using pearl script.
- classified data was imported into ArcGIS in .csv format
- point data was converted to raster with folk class number as the cell value

8.2.3. Sediment Texture – Red/Green/Blue Image

- rasters for fractions (#.2.1) were imported into ENVI
- grids were loaded into the bands of a RGB image (Gravel – red, Sand – green, Mud – blue)
- image was saved as a geotiff and imported to ArcGIS

8.3. APPENDIX C: EXPLANATION OF TABLE FIELDS

8.3.1. Chapter 3 Tables

Table 3.1. Location of Deep Sea Drilling sites in the Tasman and Coral Seas

Location	Water Depth (m)	Data	Reference
32^0 01′S; 165^0 27′E New Caledonia Basin	3196	DSDP Leg 21 Site 206	Burns et al., 1973
36^0 58′S; 165^0 26′E Southern LHR	1389	DSDP Leg 21 Site 207	Burns et al., 1973
26^0 07′S; 161^0 13′E Northern LHR	1545	DSDP Leg 21 Site 208	Burns et al., 1973
15^0 56′S; 152^0 11′E Queensland Plateau	1428	DSDP Leg 21 Site 209	Burns et al., 1973 Davies et al., 1991
13^0 46′S; 152^0 54′E Coral Sea Basin	4643	DSDP Leg 21 Site 210	Burns et al., 1973
43^0 55′S; 154^0 17′E Central Tasman Sea	4729	DSDP Leg 29 Site 283	Kennett et al., 1974
13^0 55′S; 153^0 16′E Coral Sea Basin	4632	DSDP Leg 30 Site 287	Andrews et al., 1975
21^0 11′S; 161^0 20′E Chesterfield Plateau	1111	DSDP Leg 90 Site 587	Kennett et al., 1986
26^0 07′S; 161^0 14′E LHR Faust Basin	1533	DSDP Leg 90 Site 588	Kennett et al., 1986
30^0 43′S; 163^0 38′E Lord Howe Rise	1391	DSDP Leg 90 Site 589	Kennett et al., 1986
31^0 10′S; 163^0 21′E S Lord Howe Rise	1299	DSDP Leg 90 Site 590	Kennett et al., 1986
31^0 35′S; 164^0 27′E S Lord Howe Rise	2131	DSDP Leg 90 Site 591	Kennett et al., 1986
36^0 28′S; 165^0 27′E S Lord Howe Rise	1088	DSDP Leg 90 Site 592	Kennett et al., 1986
16^0 31′S; 148^0 09′E 3.5nm E of Holmes Reef, W Queensland Plateau	937	ODP Leg 133 Site 811	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 Betzler et al., 1995 Brachert and Dullo, 2000
17^0 49′S; 149^0 36′E Tregrosse Reef Queensland Plateau slope	462	ODP Leg 133 Site 812	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 Betzler et al., 1995 McNeill, 2005

			Brachert and Dullo, 2000
17^0 50’S; 149^0 30’E Tregrosse Reef Queensland Plateau slope	539	ODP Leg 133 Site 813	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 Betzler et al., 1995 McNeill, 2005 Brachert and Dullo, 2000
17^0 50’S; 149^0 31’E Tregrosse Reef Queensland Plateau slope	520	ODP Leg 133 Site 814	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 Betzler et al., 1995 McNeill, 2005 Brachert and Dullo, 2000
19^0 09’S; 150^0 00’E Marion Plateau	466	ODP Leg 133 Site 815	Davies et al., 1991a ; McKenzie et al., 1993 ;
19^0 12’S; 150^0 01’E Marion Plateau	438	ODP Leg 133 Site 816	Davies et al., 1991a ; McKenzie et al., 1993 ;
18^0 09’S; 149^0 46’E Queensland Plateau/Townsville Trough slope	1016	ODP Leg 133 Site 817	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 Cotillon et al., 1994a McNeill, 2005
18^0 04’S; 150^0 03’E Queensland Plateau/Townsville Trough slope	749	ODP Leg 133 Site 818	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 McNeill, 2005
16^0 37’S; 146^0 19’E Great Barrier Reef	565	ODP Leg 133 Sites 819	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 Davies and Peerdeman, 1998
16^0 38’S; 146^0 18’E Great Barrier Reef	279	ODP Leg 133 Site 820	Davies et al., 1991a ; McKenzie et al., 1993 ;
16^0 39’S; 146^0 17’E Great Barrier Reef	213	ODP Leg 133 Site 821	Davies et al., 1991a ; McKenzie et al., 1993 ;
16^0 25’S; 149^0 13’E Great Barrier Reef	955	ODP Leg 133 Site 822	Davies et al., 1991a ; McKenzie et al., 1993 ;
16^0 37’S; 149^0 36’E Queensland Trough	1638	ODP Leg 133 Site 823	Davies et al., 1991 ; McKenzie et al., 1993 ;
16^0 27’S; 147^0 46’E W of Holmes Reef, W Queensland Plateau	1001	ODP Leg 133 Sites 824	Davies et al., 1991a ; McKenzie et al., 1993 ; Davies et al., 1993 Betzler et al., 1995

			Brachert and Dullo, 2000
16^{0} 31'S; 148^{0} 09'E 3.5nm E of Holmes Reef, W Queensland Plateau	939	ODP Leg 133 Site 825	Davies et al., 1991a ; McKenzie et al., 1993 ;
19^{0} 14'S; 150^{0} 01'E Marion Plateau	425	ODP Leg 133 Site 826	Davies et al., 1991a ; McKenzie et al., 1993 ;
20^{0} 34'S; 152^{0} 24'E Marion Plateau	374	ODP Leg 194 Site 1192	Isern et al., 2002 ; Anselmetti et al., 2006 Isern et al., 2001 Ehrenberg et al., 2006
20^{0} 14'S; 151^{0} 48'E Marion Plateau	348	ODP Leg 194 Site 1193	Isern et al., 2002 ; Anselmetti et al., 2006
20^{0} 15'S; 151^{0} 59'E Marion Plateau	374	ODP Leg 194 Site 1194	Isern et al., 2002 ; Anselmetti et al., 2006
20^{0} 24'S; 152^{0} 40'E Marion Plateau	419	ODP Leg 194 Site 1195	Isern et al., 2002 ; Anselmetti et al., 2006
21^{0} 00'S; 152^{0} 52'E Marion Plateau	304	ODP Leg 194 Site 1196	Isern et al., 2002 ; Anselmetti et al., 2006
21^{0} 05'S; 153^{0} 04'E	348	ODP Leg 194 Site 1197	Isern et al., 2002 ; Anselmetti et al., 2006
20^{0} 58'S; 152^{0} 44'E Marion Plateau	320	ODP Leg 194 Site 1198	Isern et al., 2002 ; Anselmetti et al., 2006
20^{0} 59'S; 152^{0} 55'E Marion Plateau	316	ODP Leg 194 Site 1199	Isern et al., 2002 ; Anselmetti et al., 2006

Table 3.2. Cores and other samples on the continental shelf off NSW and southern Queensland: general location and reference.

Location	**Water Depth (m)**	**Data**	**Reference**
Off Fraser Island Surface samples		Sedimentology, ^{14}C	Marshall et al., 1998
Off Fraser Island Surface samples		Sedimentology	Boyd et al., 2004b, Boyd et al., 2008
Off southern Queensland and NSW Surface sediments		Sedimentology	Davies, 1979
Off central NSW Cores		Sedimentology, ^{14}C, amino acid racemisation	Freland and Roy, 1997 Ferland et al., 1995 Murray-Wallace et al., 2005

Off central NSW Cores		Sedimentology, trace metals	Matthai and Birch, 2000
Off central NSW Surface sediments		Sedimentology	Boyd et al., 2004a
Off Sydney Surface samples		Sedimentology, heavy metals	Birch and Davey, 1995
Off Newcastle Surface samples		Sedimentology, trace metals	Matthai and Birch, 2000
Off Sydney Surface sediments		Sedimentology	Albani and Rickwood, 2000
Off northern NSW Surface sediments		Sedimentology	Boyd et al., 2004a
Off northern NSW Cores		Sedimentology	Roberts and Boyd, 2004
Off NSW Surface samples		Sedimentology	Shirley, 1964

Table 3.3. Bottom photography of the continental shelf off NSW and southern Queensland.

Location	Water Depth (m)	Data	Reference
33^{0} 52′S; 151^{0} 22′E Off Sydney	~ 75	Muddy bottom, pit, mounds, tracks, trails	Conolly, 1969
34^{0} 10′S; 151^{0} 08′E Off Sydney	~ 45	Sand with ripples	Conolly, 1969
34^{0} 13′S; 151^{0} 14′E Off Sydney	~ 120	Muddy bottom, tracks, trails, epifauna	Conolly, 1969
Off Fraser Island	Outer shelf	Rhodoliths and corals	Marshall et al., 1998; Davies and Peerdeman, 1998.
Off Evans Head and Cape Byron	40-68	Calcareous gravel, sand, rock, sea urchins, sponges	Jones and Kudras, 1982

Table 3.4. Sea floor photography of continental slope off NSW and southern Queensland: location, data collected and reference.

Location	Water Depth (m)	Data	Reference
34^{0} 04′S; 151^{0} 37′E Off Sydney	~280	Muddy bottom, pits, mounds,	Conolly, 1969

		tracks, trails	
Off Sydney			Glenn et al., 2007
28^{0}S to 32^{0}S Evans Head to Yamba Cores and dredges	100-3955 m	Iron-rich glauconite foraminifer sands. Phosphate and iron hardgrounds	O'Brien and Heggie, 1990.

Table 3.5. Cores and surface samples analysed from the east Australian continental slope.

Location	Water Depth (m)	Data	Reference
26^{0} 30'S; 153^{0} 53'E Off Noosa	842	58% carbonate, 70% mud, ^{14}C, ^{18}O.	Troedson and Davies, 2001
26^{0} 35'S; 153^{0} 51'E Off Noosa	1022	53% carbonate, 82% mud, ^{14}C, ^{18}O	Troedson and Davies, 2001
33^{0} 57'S; 151^{0} 55'E Off Sydney	1467	46% carbonate, 55% mud, ^{14}C, ^{18}O	Troedson and Davies, 2001
33^{0} 59'S; 152^{0} 00'E Off Sydney	2007	47% carbonate, 82% mud, ^{14}C, ^{18}O	Troedson and Davies, 2001
Upper continental slope, central NSW		11 cores, carbonate, mud, ^{14}C	Glenn et al., 2007
33^{0} 55.5'S; 151^{0} 51.5'E Off Sydney	977	Grain size, carbonate, magsus.	Howard, 1993
34^{0} 00.5'S; 152^{0} 04.0'E Off Sydney	2445	Grain size, carbonate, mag sus.	Howard, 1993
34^{0} 06.5'S; 152^{0} 08.5'E Off Sydney	3017	Grain size, carbonate, mag sus.	Howard, 1993
Upper continental slope between 31^{0} to 33^{0} S.	200-1600	8 cores described	Hubble and Jenkins, 1984.
Upper continental slope between 36^{0} and 37^{0} 15'S.	392-1200	5 cores described	Hubble and Jenkins, 1984.
31^{0} 34'S; 153^{0} 33'E Off Smoky Cape	3768	46% carbonate, silty mud	Eade and van der Linden, 1970
Off Breaksea Spit Surface samples	50 – 3500	Sedimentology, luminescence	Boyd et al., 2008

Off northern NSW One core	125	Biogenic muddy gravel (sponge spicules, bryozoa)	Roberts and Boyd, 2004
Off Fraser Island Surface samples	105 – 250	Foraminifer, molluscs, bryozoans, coralline algae	Marshall et al., 1998
Off Evans Head, NSW Two cores	1000-2000	48,56% carbonate, 59,84% mud	Lane and Heggie, 1993.
Off central NSW Four cores	167-238	90,70,64,59% carbonate, 10-20% mud, <10% biogenic gravel, C14.	Ferland and Roy, 1997. Heggie et al., 1993.
28^0S to 32^0S Evans Head to Yamba Cores and dredges	100-3955 m	Iron-rich glauconite foraminifer sands. Phosphate and iron hardgrounds	O'Brien and Heggie, 1990.

Table 3.6. Dredge Samples from the east Australian continental slope: Location and Reference

Location	Water Depth (m)	Data	Reference
29^0 23'S; 153^0 50'E	385	Phosphate concretions	Von der Borch, 1970. Kress and Veeh, 1980.
30^0 41'S; 153^0 18'E	210	Nodules ferruginised and phosphatised with bones and teeth.	Von der Borch, 1970. Kress and Veeh, 1980.
30^0 40'S; 153^0 20'E	265	As above	Von der Borch, 1970.
30^0 01'S; 153^0 18'E	290	As above	Von der Borch, 1970.
34^0 22'S; 151^0 58'E	4219	Metasediments, metavolcanics, ?Palaeozoic	Heggie et al., 1992
34^0 14'S; 152^0 08'E	3967	Mudstone, sandstone, mid to late Campanian	Heggie et al., 1992
34^0 16'S; 152^0 09'E	4612	Sandstone, Triassic. Mudstone, ?late Mesozoic	Heggie et al., 1992

34^0 09’S; 152^0 15’E	4818	Basaltic andesite. Mudstone, ?late Mesozoic.	Heggie et al., 1992
34^0 09’S; 152^0 14’E	4290	Volcanic sandstone, mudstone, late Cretaceous. Mn/Fe nodules and crusts	Heggie et al., 1992
33^0 59’S; 152^0 16’E	3533	Sandstone, mudstone, glauconitic calcareniter, early Paleocene - Eocene	Heggie et al., 1992
33^0 49’S; 152^0 04’E	1606	Mudstone, lithic sandstone, ?late Mesozoic. Living corals, sponges, annelids, echinoderms, brachiopods, bivalves, gastropods	Heggie et al., 1992
33^0 45’S; 152^0 06’E	1745	Mudstone, early Eocene. Glauconitic calcarenite, ?Paleocene	Heggie et al., 1992
33^0 32’S; 152^0 25’E	3082	Sandstone, siltstone, mid to late Campanian	Heggie et al., 1992
33^0 12’S; 152^0 46’E	3470	Vesicular basalt, hyaloclastite. Sandstone	Heggie et al., 1992
33^0 34’S; 152^0 21’E	2876	Volcanic breccia of basalt and ?rhyolite. Lithic sandstone, mudstone mid to late Campanian	Heggie et al., 1992
34^0 02’S; 151^0 39’E	420	Ferruginised/phosphatised basaltic breccia	Jenkins, 1991.
33^0 59.1’S; 152^0 16.5’E 112/DR008	3533-3306	Glauconitic calcarenite, early Paleocene.	Quilty et al., 1997
37^0 12’S; 150^0 45’E	3750	Granodiorite, Middle Devonian	Hubble et al., 1992
37^{0}14’S; 150^0 42’ E	4000	Granodiorite, Middle Devonian	Hubble et al., 1992
36^0 06’S; 150^0 39’E	2610-2155	Limestone, latest Silurian-Early Devonian. Fe/Mn coated shale and siltstone	Packham et al., 2006
36^0 10’S; 150^0 34’E	1700	Leuco-quartz monzodiorite, Early Cretaceous, 101 Ma	Hubble et al., 1992
36^0 32’S; 150^0 48’E	4500	Serpentinite, mudstone	Hubble et al., 1992
36^0 38’S; 150^0 48’E	4500	Serpentinite, mudstone	Hubble et al., 1992
37^0 07’S; 150^0 46’E	4000-4500	Lithic sandstone	Packham et al., 2006

37^0 13′S; 150^0 44′E	4000-4500	Meta-basalt	Hubble et al., 1992
37^0 17′S; 150^0 46′E	4000-4500	Meta-basalt, marble	Hubble et al., 1992
36^0 17′S; 150^0 35′ E	1750	Schist, slate, limestone. Fe/Mn coated scoriaceous basalt lava blocks in late Paleocene limestone	Quilty and Packham, 2006
35^0 57.5′S; 151^0 39.2′E	~ 200	Green foraminiferal sand	Conolly, 1969
34^0 00.2′S; 151^0 44.2′E	~ 500	Green sand	Conolly, 1969
34^0 3.2′S; 151^0 51.5′E	~ 1200	Calcareous green mud	Conolly, 1969
34^0 08′S; 152^0 00′E	~ 1700	Calcareous green mud	Conolly, 1969
34^0 09′S; 151^0 55′E	~ 2000	Calcareous green mud	Conolly, 1969
34^0 13′S; 151^0 38′E	~ 700	Calcareous green mud	Conolly, 1969
Off Fraser Island	270-600	Shallow water limestone, dolomitic limestone (Oligocene-middle Miocene). Stable isotopes.	Marshall et al., 1998

Table 3.7. Sea floor photography of the Tasman Basin: Location and Reference

Location	**Water Depth (m)**	**Data**	**Reference**
34^0 35.7′S; 152^0 02.5′E Abyssal plain at foot of continental slope E of Nowra	4820	Pebbles and blocks in bioturbated mud. Current indicators	Jenkins et al., 1986
30^0 45.5′S; 153^0 46.8′E Abyssal plain at foot of continental slope E of Coffs Harbour	4515-4585	Strong current indicators in bioturbated mud	Jenkins et al. 1986
30^0 40.6′S; 154^0 21.4′E E of Coffs Harbour	4365-4432	Crest of linear sediment drift. Current indicators	Jenkins et al., 1986
30^0 43.8′S; 154^0 29.2′E E of Coffs Harbour	4640	E flank of sediment drift	Jenkins et al., 1986
33^0 22′S; 156^0 45′E	4800-4811	Between Taupo Smt and Dampier Ridge	Baker et al., 1988a

31^0 41′S; 155^0 51′E Abyssal hills	4705-4750		Baker et al., 1988a
32^0 20′S; 154^0 20′E Abyssal plain	4730-4735		Baker et al., 1988a
35^0 33.3′S; 155^0 40.4′E	4408-4418	Mn nodules and bioturbated sediment	Glasby et al., 1986

Table 3.8. Cores and dredge samples from the Tasman Basin: Location and Reference

Location	**Water Depth (m)**	**Data**	**Reference**
36^0 15′S; 155^0 35′E	4300	Mn nodules, greenish grey calcareous mud	Exon et al., 1980
35^0 48.6′S; 156^0 31.8′E	4714-4548	Mn nodules	Glasby et al., 1986
34^0 50′S; 155^0 28′E	~ 4500	Red clay	Conolly, 1969
36^0 41′S; 158^0 29′E	~ 4500	Red clay	Conolly, 1969
31^0 37′S; 154^0 14′E	4565	40% carbonate, sandy mud	Eade and van der Linden, 1970
31^0 31′S; 155^0 01′E	4654	43% carbonate, silty mud	Eade and van der Linden, 1970
31^0 29′S; 155^0 45′E	4838	55% carbonate, clay	Eade and van der Linden, 1970
31^0 29′S; 156^0 13′E	4689	55% carbonate, silty mud	Eade and van der Linden, 1970
31^0 31′S; 156^0 54′E	4283	42% carbonate, silty mud	Eade and van der Linden, 1970
Numerous cores in Tasman Basin	4082-4830	Carbonate dissolution	Martinez, 1994b

Table 3.9. Size of erosion scours at base of Tasmantid Seamounts in the EMR deduced from Eltanin seismic records (from Jenkins, 1984)

Seamount Location	Seamount height (m)	Seamount width at base (Km)	Moat width (Km)	Moat depth (m)
33^0 36′S; 153^0 54′E Unnamed seamount	664	10.8	12-23 east and west side	30-48
28^0 12′S; 155^0 48′E Britannia Seamount	4270	43	>29 east side	332

25^{0} 48′S; 154^{0} 30′E Recorder Seamount	3567	43	6 west side	18

Table 3.10. Sea floor photography of Tasmantid seamounts: location, data collected and reference.

Location	**Water Depth (m)**	**Data**	**Reference**
36^{0} 37.8′S; 155^{0} 31.0′E Gascoyne Smt South of EMR	4840-4880	Eroded scoured moat at W foot. Gravel and boulder lag.	Jenkins et al., 1986
30^{0} 50′S; 156^{0} 42′E Derwent Hunter Seamount	4614-4592	Eroded scoured moat	Baker et al., 1988a

Table 3.11. Cores and Dredge Samples from the Tasmantid and Lord Howe Seamount chains: Location and Reference

Location	**Water Depth (m)**	**Data**	**Reference**
36^{0} 39′S; 156^{0} 14′E Gascoyne Smt	600-900	Basalt. Petrography and K-Ar	McDougall and Duncan, 1988
33^{0} 06′S; 156^{0} 17′E Taupo Bk	500-750	Basalt and limestone Petrography and K-Ar	McDougall and Duncan, 1988; Slater & Goodwin, 1973
32^{0} 59′S; 156^{0} 14′E Taupo Bk	500-750	Petrography and K-Ar	McDougall and Duncan, 1988
30^{0} 56′S; 156^{0} 14′E Derwent Hunter G	600-1000	Petrography and K-Ar	McDougall and Duncan, 1988
30^{0} 47′S; 155^{0} 21′E Derwent Hunter G	1150-1250	Basalt, limestone and phosphorite. Petrography and K-Ar	McDougall and Duncan, 1988; Slater & Goodwin, 1973
28^{0} 38′S; 155^{0} 27′E Britannia G	1100-1400	Petrography and K-Ar	McDougall and Duncan, 1988
27^{0} 29′S; 155^{0} 18′E Queensland G	1500-1900	Petrography and K-Ar	McDougall and Duncan, 1988
Barcoo	300-350	Basalt and limestone	Slater & Goodwin, 1973
Gifford	300-350	Limestone and phosphorite	Slater & Goodwin, 1973
Lord Howe	50-350	Limestone	Slater & Goodwin, 1973

Table 3.12. Cores samples from the plateaus and rises in the Tasman Sea: Location and Reference

Location	Water Depth (m)	Data	Reference
33^0 10′S; 159^0 27′E Lord Howe Rise	3609	85% carbonate, very sandy mud	Eade and van der Linden, 1970
33^0 23′S; 161^0 37′E Lord Howe Rise	1448	93% carbonate, sandy mud	Eade and van der Linden, 1970
33^0 31′S; 164^0 03′E Lord Howe Rise	1834	94% carbonate, sandy mud	Eade and van der Linden, 1970
33^0 30′S; 165^0 02′E New Caledonia Basin	3045	93% carbonate, sandy mud	Eade and van der Linden, 1970
Numerous core on Lord Howe Rise and New Caledonia Basin	1500-3000	Carbonate dissolution	Martinez, 1994b
Lord Howe Rise		^{18}O	Nelson et al., 1994
30^0 33′S; 161^0 26′E Lord Howe Rise	1340	Benthic forams ^{18}O	Nees, 1997
33^0 23′S; 161^0 37′E Lord Howe Rise	1448	Benthic forams ^{18}O	Nees, 1997
25^0 16′S; 162^0 00′E Lord Howe Rise	1299	^{18}O, foram-nanno ooze, primary production, dust	Kawahata, 2002, Kawahata et al., 1999 Kawagata, 2001
30^0 00′S; 162^0 00′E Lord Howe Rise	1158	^{18}O, foram-nanno ooze, primary production, dust	Kawahata, 2002, Kawahata et al., 1999 Kawagata, 2001
35^0 00′S; 162^0 31′E Lord Howe Rise	1338	^{18}O, foram-nanno ooze, primary production, dust	Kawahata, 2002, Kawahata et al., 1999 Kawagata, 2001
35^0 30′S; 161^0 00′E Lord Howe Rise	3166	^{18}O, coccolith ooze, primary production, dust	Kawahata, 2002, Kawahata et al., 1999 Kawagata, 2001
27^0 46′S; 160^0 13′E W LHR Capel Basin Core MD06-3036	2505	Geochemical studies	Colwell et al., 2006
27^0 47′S; 160^0 11′E W LHR Capel Basin Core MD06-3037	2584	Geochemical studies	Colwell et al., 2006
27^0 47′S; 160^0 11′E W LHR Capel Basin Core MD06-3038	2585	Geochemical studies	Colwell et al., 2006

Table 3.13. Dredge samples from the plateaus and rises in the Tasman Sea: Location and Reference

Location	Water Depth (m)	Data	Reference
28^0 34′S; 163^0 00′E Central LHR, Vening-Meinesz FZ			Roeser et al., 1985
28^0 38′S; 163^0 04′E Central LHR, Vening-Meinesz FZ	1650	Mn crust, breccia, conglomerate	Colwell et al., 2006
28^0 33′S; 163^0 00′E Central LHR, Vening-Meinesz FZ	1600	Mn crust, volcaniclastic, limestone breccia	Colwell et al., 2006
28^0 25′S; 162^0 47′E Central LHR, Vening-Meinesz FZ	1700-1450	Mn crusts, nodules, volcanics, breccia and epifauna.	Colwell et al., 2006
E flank of southern Lord Howe Rise		Basalt, hyaloclastic breccia	Launay et al., 1976 Willcox et al., 1981
Dampier Ridge		Granite, ?andesite, 250-270 Ma	McDougall et al., 1994

Table 3.14. Bottom photography from the Lord Howe Rise, Dampier Ridge, Cato Trough, Kenn Plateau and Mellish Rise: Location and Reference

Location	Water Depth (m)	Data	Reference
23^0 15′S; 154^0 55′E	3000-3200	BC1	Walker, 1992
22^0 37′S; 155^0 03′E	3380	BC2	Walker, 1992
22^0 34′S; 155^0 30′E	3068	BC3	Walker, 1992
32^0 59′S; 160^0 01′E W flank LHR	1552-1560		Baker et al., 1988a
28^0 34′S; 162^0 52′E Channel LHR	1698-1700		Baker et al,. 1988a
29^0 59′S; 159^0 52′E W slope LHR	1992-200		Baker et al., 1988a
30^0 52′S; 156^0 47′E Base of Dampier Ridge	4556-4374		Baker et al., 1988a

Table 3.15. Cores samples from the Cato Trough, Kenn Plateaus and Mellish Rise: Location and Reference

Location	Water Depth (m)	Data	Reference
22^0 37.7′S; 155^0 03.5′E	3380	Calcareous sandy mud	Walker, 1992

22⁰ 34.3'S; 155⁰ 30.5'E	3068	Calcareous sandy mud	Walker, 1992
19⁰ 43.3'S; 154⁰ 59.3'E	3152	Calcareous sandy mud	Walker, 1992

Table 3.16. Dredge samples from the Cato Trough, Kenn Plateau and Mellish Rise: Location and Reference

Location	Water Depth (m)	Data	Reference
Numerous dredges from Kenn Plateau		Petrography and age	Exon et al., 2006

Table 3.17. Cores and other Samples from the Marion Plateau: Location and Reference

Location	Water Depth (m)	Data	Reference
20.8⁰S; 152.3⁰E Marion Plateau cores	320	Carbonate, Sr sedimentology, ^{18}O	Page and Dickens, 2005

Table 3.18. Cores and other Samples from the Queensland Plateau, Townsville and Queensland Troughs: Location and Reference

Location	Water Depth (m)	Data	Reference
Queensland Trough 154 surface samples and cores		Carbonate %, mineralogy, Sr	Dunbar and Dickens, 2003a; Francis et al., 2007
Queensland Trough and Plateau cores		Carbonate, stratigraphy, ^{14}C	Dunbar et al., 2000
Queensland Trough cores		Carbonate, sedimentology, ^{18}O	Dunbar and Dickens, 2003b
Queensland Trough cores		Carbonate, sedimentology, ^{14}C	Page et al., 2003
Queensland Trough cores		Carbonate, Sr sedimentology, ^{18}O	Page and Dickens, 2005
Townsville Trough		Carbonate, sedimentology, ^{14}C	Harris et al., 1990
Queensland Plateau Surface samples		Sediment type	Gardner, 1970

Table 3.19. Cores and other Samples from the Eastern Plateau and Reefs: Location and Reference

Location	**Water Depth(m)**	**Data**	**Reference**
9^{0} 54′S; 144^{0} 39′E Ashmore Trough	760	Dark grey calcareous mud, ^{14}C, ^{13}C, ^{18}O	de Garidel-Thoron et al., 2004
At shelf edge	100-120	3 cores, ^{14}C	Harris et al., 1996b.
Ashmore Trough Cores MD05		Core for palaeoclimate studies IMAGES	Beaufort et al., 2005

Table 3.20. Cores and other Samples from the Coral Sea Basin, Louisiade Plateau and Louisiade Trough: Location and Reference

Location	**Water Depth (m)**	**Data**	**Reference**
Coral Sea Basin Surface samples		Sediment type	Gardner, 1970

Table 3.21. Cores and other Samples from the Norfolk Island ridges and basins: Location and Reference

Location	**Water Depth (m)**	**Data**	**Reference**
79 dredge locations Norfolk Basin	various	Rock petrography, K-Ar dating.	Various authors listed in DiCaprio et al., 2007. Mortimer, 1998.
32^{0} 01′S; 165^{0} 28′E New Caledonia Basin Core MD97-2123		Paleoclimate, IMAGES	Marion Dufresne MD106, 1997
26^{0} 46′S; 163^{0} 38′E W Fairway Basin Core MD97-2124		Paleoclimate, IMAGES	Marion Dufresne MD106, 1997
30^{0} 26′S; 165^{0} 56′E E Fairway Basin seamount dredge	2704-2456	Foram nanno-ooze	Colwell et al., 2006
27^{0} 43′S; 165^{0} 17′E E Fairway Basin seamount dredge	2900	Volcaniclastic breccia, sandstone, Mn crust	Colwell et al., 2006
26^{0} 33′S; 165^{0} 01′E E Fairway Basin Core MD06-3029	2889	Geochemical studies	Colwell et al., 2006

26^0 35’S; 164^0 46’E E Fairway Basin Core MD06-3030	2928	Geochemical studies	Colwell et al., 2006
26^0 35’S; 164^0 46’E E Fairway Basin Core MD06-3032	2930	Geochemical studies	Colwell et al., 2006E

8.3.2. Chapter 4 Tables

E.g. Table 4.1

Feature	Area in EMR	% total* EMR Area	% EEZ Area	% Total EEZ area located in EMR	Water Depth Range** in EMR (m)

Area in EMR: Area in km² covered by this feature within the EMR.

% total* EMR Area: Percent of the total area of the EMR (not including areas with water depths <10 m) which is allocated to this feature.

% EEZ Area: Percent of the total area of the EEZ which is allocated to this feature.

% Total EEZ area located in EMR: The proportion of the EEZ area allocated to this feature that lies within the EMR.

Water Depth Range in EMR (m):** Range of water depths occurring in the EMR area (not including areas with water depths <10m) allocated to this feature. To reduce error, depths were determined from the point data underpinning the bathymetry grid rather than the interpolated data. Values are rounded to the nearest 10 m.

E.g. Table 4.2

PROVINCE/ # Feature	No. sample points	% EMR Area	Average sample density

PROVINCE/ # Feature: Features are nested within Provinces. Shelf, Slope, Rise and Abyssal Plain/Deep Ocean Floor Provinces are capitalised. Statistics for Provinces include the area of all features occurring within them. Feature names are not capitalised. Shelf, slope, rise and AP/DOF features comprise the area of these provinces with no other features identified within them.

No. sample points: The total number of samples used in this study that are located within the area allocated to this province or feature. Some samples included in this figure have only textural or compositional data.

%EMR Area: As in Table 4.1.

Average sample density (samples per km²): The average sample density across all occurrences of the feature in the EMR. This is calculated by dividing the total area of the feature by the number of sample points within it. Results have been rounded to the nearest 100 km².

8.3.3. Chapter 5 Tables

E.g. Table 5.1

Bioregion	No. sample points (no. added for task)	% EMR Area*	Average sample density (km²)

No. sample points (no. added for task): The number of sample points occurring in the bioregion including both data existing before this task and new assays generated for this task. The number of samples added to this bioregion for this task is given in brackets.
%EMR Area: Percentage of the total area of the NWMR allocated to this bioregion. Percentages are calculated from the NWMR including the area not assigned to any bioregion.
Average sample density (km²): As for Table 4.2.

E.g. Table 5.2

Feature	% of bioregion area covered	% of EMR area this unit lies within this bioregion	% of EEZ area this unit lies within this bioregion

% of bioregion area covered: The percentage of the total area of the bioregion that is included in the NWMR that falls within this feature. Calculations do not include areas with water depths <10 m.

% of EMR area this unit lies within this bioregion: The percentage of the total area covered by this feature in the EMR that lies within the area of this bioregion included in the EMR.

% of EEZ area this unit lies within this bioregion: The percentage of the total area covered by this feature in the EEZ that lies within the area of this bioregion included in the EMR.

E.g. Table 5.3

Feature	Depth Range (m)	Mean Depth (m)

Depth Range (m): Range of water depths occurring in the area of this feature within the bioregion(not including areas with water depths <10 m). To reduce error, depths were determined from the point data underpinning the bathymetry grid rather than the interpolated data. Values are rounded to the nearest 10 m.

Mean Depth (m): The mean water depth occurring in the area of this feature within the bioregion. To reduce error, depths were determined from the point data underpinning the bathymetry grid rather than the interpolated data. Areas with water depths <10 m were removed prior to calculations. Values are rounded to the nearest 10 m.

8.4. APPENDIX D: METADATA

(To be included with GIS files in final report DVD)

8.5. APPENDIX E: DATA GENERATED

See excel workbook "EMR Task 2007 Assays".

8.6. APPENDIX F: LASER GRAINSIZE DISTRIBUTIONS

See PDF file "Appendix F EMR Laser Reports".

8.7. APPENDIX G: WEB ACCESSIBLE DIGITAL MAPS FOR DATA COVERAGE AND SEDIMENT PROPERTIES

(To be included in final report DVD)

Instructions for the DVD

Sedimentology and Geomorphology of the East Marine Region: A Spatial Analysis

This DVD contains the above-titled Report as Record 2008/10.pdf

View this .pdf document using Adobe Acrobat Reader (Click Adobe.txt for information on readers)

Click on: Record 2008/10.pdf to launch the document.

Directories on this DVD:

Appendix D: Metadata File with electronic documents as .txt files

Appendix E: Data Generated (Refer to EMR_Task_2007_Assays.xls)

Appendix F: Laser grainsize distributions (Refer to Appendix_F_EMR_Laser_Reports.pdf)

Appendix G: Web Accessible Digital Maps for Data Coverage and Sediment Properties

Within the directory of GIS Files, sub-directories include: boundaries, georef image files, layer files, polygons, rasters and sample points. All these subdirectories can be viewd using ARC GIS Catelogue and ARC MAP. Sub-directories of figures include three different formats of all figures found in the report: JPEG, GIF and TIFF.